Fermilab
FY2002 Self-assessment
Process Assessment Report
For
Technical Division

01-Oct-2002

Division/Section performing assessment

Technical Division

Name of organization that owns assessed process

Development & Test Department

Organization Strategy

A major component of the Technical Division mission is the measurement of magnetic devices to support the work of HEP. Superconducting devices are measured at cryogenic temperatures. Maintaining these temperatures (e,g, 4 degrees Kelvin for Tevatron devices) requires very elaborate and sophisticated refrigeration systems. The overall maintenance and operations of the cryogenic systems is crucial for the success of the Magnet Test Facility.

Names of Personnel on Assessment team

Ted Beale, Quality Control Supervisor
Jamie Blowers, Quality Assurance Officer

Name of process assessed

Magnet Test Facility cryogenic operations

Brief description of process to be assessed

The Magnet Test Facility (MTF) is responsible for the measurements of both conventional and superconducting devices. Measuring superconducting devices requires the use of very elaborate cryogenic systems. It is the processes used in the maintenance and operations of these cryogenic systems which was assessed.

Are metrics associated with this process? If so, what are they?

There are no contractual or internal metrics associated with this process.

What are the names of the procedures associated with this process?

The list of procedures is too long to record here. Instead, the second attachment is the table of contents listing the various procedures associated with this process.

Are these procedures being followed? Are they current?

These procedures appear to be current, and they are being followed to a high degree. It appears that some records are not being updated, as is called out in some of the procedures.

Describe the methodology used to assess this process.

The methodology used to assess this process consisted of reviewing the available documentation, interviewing personnel involved with the process, and gathering records.

Results of the assessment:

We looked at two main topics within the overall system: operations and maintenance. The operations portion appears to be well under control, while maintenance needs a little attention. Overall the process is given a rating of **good**.

The personnel interviewed appear to all be well trained, and fully aware of their responsibilities. The MTF organization is such that management fully trust the employees to appropriately complete the work, and so management does not feel compelled to need to know every detail of the daily operations of the facility. This makes it a bit difficult for auditing, but it translates into what appears to be a healthy working environment (i.e. micro-managing is not in MTF's vocabulary). If a person did not know the answer to a specific question, they knew who would.

As stated above, the operations of the cryogenic system appears to be in good shape. There are procedures which are under document control (see attached list). Personnel are aware that the version on the network is the most recent version. As required, these procedures are updated and personnel are informed of the changes. Checklists are being maintained of work done during operation of the cryogenic systems (see attached). There is a logbook maintained at each test stand, which provides a record of events and issues related to the test stand and its operation. Prior to the startup of any new system or any system that has had a major upgrade, the cryogenic safety committee conducts thorough reviews of all parameters. All in all, these process controls appear to be adequate.

Maintenance of the cryogenic systems is in need of some attention. There are systems in place which define the maintenance requirements, but there was not much evidence to show that the maintenance is being done in a timely manner. Personnel interviewed stated that the maintenance is being done when it should be, but acknowledge that the records of this work are lacking. There are two sources of maintenance records: an electronic set on the network, and a binder with a paper set. The binder is to be moved

around from system to system, so that a record can be made at the time the work is done. The maintenance system is designed so that the electronic versions should be updated regularly, providing a central record of the accomplished maintenance. Both of these logs are only sparsely filled out.

Identified opportunities for improvement

Review the maintenance system, and further refine it so that actual maintenance matches what is supposed to be done. The system should be designed so that it is conducive to maintaining the appropriate records.

Schedule for implementation of improvements

The report of this assessment was completed on October 2, and so a schedule has not been put together.

Status of improvements from previous assessment

N/A

Attachments (supporting data, worksheets, reports, etc.)

The following attachments have been incorporated into this report:

"Audit Checklist" - The checklist used to record results of interviews

"List of procedures" - The table of contents listing the various policies/procedures associated with this process

"MTF-REF-2400-0" - The operating procedure for the Vertical Magnet Test Facility (VMTF) refrigerator mode

"VMTF Checklists" - Completed checklists for the (VMTF) test stand operations

"Electronic Maintenance Logs" - Maintenance logs which are located on the computer network

"Paper Maintenance Logs" - Maintenance logs which are maintained as hard-copies in the binder

"Cryogenic Safety Review" - E-mail records regarding the safety review of stand 4

Fermilab Audit Checklist

Reference	*Criteria*	*Results* Sat	Unsat	*Comments*
	Audit the following subset of documents for the MTF Cryogenic System:	☒	☐	Interviewed Dan Massengill and George Kirschbaum. Reviewed documentation and completed checklists.
MTF-REF-2400-0	Cryogenic Operating Procedures – Refrigerator Mode			MTF-REF-2400-0 provides operating instructions for the Cryogenic Refrigerator Mode. This procedure documents and aids in the operation of the Cryogenic System's "Refrigerator Mode" and is only performed by trained personnel. The procedure is used as an aide by technicians operating the system; less experienced technicians usually refer to this instruction more frequently due to the number of steps involved. Five checklists and a handwritten log are associated with this procedure, and are to be completed as required. The procedure lists the operational states in order, with the exception of the "Overnight Condition" that is performed at the end of the last scheduled shift the day during test. Copies of completed checklists and pages from the VTMF logbook are attached. (The completed checklists obtained during the audit, don't have the "Doc. No." in the upper right-hand corner).
MTF-REF-2401-0	VMTF Pre-LN2 Cooldown Checklist			
MTF-REF-2402-0	VMTF Pre-LHE Cooldown Checklist			
MTF-REF-2403-0	VMTF Overnight Shutdown Checklist			
MTF-REF-2404-0	VMTF Pre-Warmup Checklist			
MTF-REF-2405-0	VMTF Warm and Secure Checklist			
VTMF Logbook	Check all insulating vacuums (dewar, transfer lines, etc.). Make a note of them in the VMTF logbook.			
		☐	☐	
		☐	☐	
		☐	☐	

Fermilab Audit Checklist

Reference	*Criteria*	*Results* *Sat*	*Unsat*	*Comments*
	Maintenance management	☐	☒	Roger Rabehl oversees and coordinates the maintenance and operations for MTF Cryogenic Systems. Routine maintenance is intended to be performed at set intervals that are based on manufacturer's recommendations and/or experience. The maintenance logs produced haven't been maintained and are incomplete; it seems that they are being filled out in a manner different than intended. There are no instruction(s) available for completion of the maintenance logs. There is insufficient evidence to determine whether or not the maintenance schedule is being adhered to. Roger maintains an electronic list of non-routine maintenance that needs to be performed. The input for the list comes from feedback from the operators and/or anyone who uses the system that identifies a problem that requires maintenance or repair. Major upgrades may involve the Project Manager, Safety, Physicists, Instrument Controls and various other personnel as required. Non-emergency maintenance/upgrades are scheduled around the test schedule.
		☐	☐	
		☐	☐	
		☐	☐	

MTF-REF #	General Description	Date entered	Rev. Date	# Of Pages
0001-0	Fitness for duty policy (1/28/99)	1/28/1999		1
0002-0	CTI 1500 Standing orders (1/28/99)	1/28/1999		3
0003-0	Oxygen Monitor, Head Alarm / Failure procedure (7/16/93)	1/28/1999		4
0010-0	CTI 1500 Pre-start set up checklist (6/30/99)	6/30/1999		4
0010-1	CTI 1500 Start up procedure (7/16/93)	6/11/1998		7
0010-2	CTI 1500 Cold System Check list (7/16/93)	6/11/1998		3
0020-0	CTI 1500 Emergency Shutdown Criteria (5/12/92)	6/11/1998		2
0020-1	Emergency Stop Button Policy (7/16/93)	6/11/1998		2
0020-3	CTI 1500 Emergency Shutdown Procedure (7/16/93	6/11/1998		2
0021-0	CTI 1500 Refrigerator Power reduction plan (4/28/92)	6/16/1998		2
0021-1	CTI 1500 Refrigerator Power reduction Checklist (7/16/93)	6/16/1998		3
0025-0	Cold Box Warm-up Checklist (7/16/93)	6/11/1998		3
0025-1	Cold Box Warm-up Procedure (7/16/93)	6/11/1998		4
0025-2	Shutdown Checklist (7/16/93)	6/11/1998		3
0280-0	Required Safety procedure for handling Anhydrous Oil (7/16/93)	6/16/1998		3
0281-0	CTI 1500 Room temperature operating fluids inventory / waste policy (05/11/92)	6/16/1998		2
0541-0	SSC Test stand 4 Scrub Procedure (12/16/91)	6/16/1998		2
0542-0	Test stand 4 Pre-cool down checklist (05/11/92)	6/16/1998		3
0542-1	125 Degree restricted cool down procedure for stand 4 (11/27/91)	6/16/1998		4
0542-2	Unrestricted cool down procedure for test stand 4 (11/27/91)	6/16/1998		3
0542-3	Test stand 4 ten degree Kelvin Operating Procedure (4/24/92)	6/16/1998		3
0543-0	SSC Test stand Pre Warm-up Checklist (11/18/91)	6/16/1998		2
0543-1	Test stand 4 Warm-up procedure (11/6/91)	6/16/1998		3
0543-2	Operations Bulletin #900219 Purge helium through SSC magnets (2/19/90)	6/16/1998		2
0544-0	Test stand 4 Warm / Secure checklist (12/2/91)	6/16/1998		3
0551-0	SSC test stand 5 Scrub procedure (12/6/91)	6/16/1998		3
0552-0	Test stand 5 Pre cool-down checklist (3/9/92)	6/16/1998		3
0552-1	125 Degree restricted cool down procedure for stand 5 (11/27/91)	6/16/1998		4
0552-2	Unrestricted cool down procedure for test stand 5 (11/27/91)	6/16/1998		4
0552-3	Test stand 5 ten degree Kelvin Operating Procedure (4/23/92)	6/16/1998		3
0553-1	Test stand 5 Warm-up procedure (11/20/91)	6/16/1998		3
0554-0	SSC Test stand 5 Warm / Secure checklist (11/20/91)	6/16/1998		3
0561-0	Saver test stands 2 and 6 Scrub procedures (7/16/93)	6/16/1998		3
0562-0	Test Stand #2 & #6 Pre-Cool down Checklist (7/16/93)	6/16/1998		3
0562-1	Saver test stands 2 & 6 Cool-down procedure's w/ Auxiliary sub-cooler and cold pump (7/16/93)	6/16/1998		3
0562-9	Cold Test Stand Final Checklist (7/16/93)	6/16/1998		3
0563-0	Saver Test Stand Pre-Warm-up Checklist (7/16/93)	6/16/1998		2
0563-1	Saver Magnet test stand Warm-up Procedure (7/16/93)	6/17/1998		3
0564-0	Saver test stands 2 and 6 Warm / Secure checklist (7/16/93)	6/17/1998		3
0570-0	LHC Test stand 4 Cryogenic Procedures (9/26/01)	5/27/2002		12
0571-0	Test Stand 4 Pre Cool-down Checklist (1/29/01)	1/29/2001		1
0572-0	Test Stand 4 Overnight Shutdown Checklist (1/29/01)	1/29/2001		1
0573-0	Test Stand 4 Pre Warm-up Checklist (1/29/01)	1/29/2001		1
0574-0	Test Stand 4 Warm / Secure Checklist (1/29/01)	1/29/2001		2

MTF-REF #	General Description	Date Entered	Rev. #	# Of Pages
1100-0	Green (Bacon Tank) Purifier Pre Start-up Checklist (7/16/93)	6/11/1998		2
1101-0	Green (Bacon Tank) Purifier Cool down & Operating Procedure (7/16/93)	6/11/1998		2
1200-0	Blue (A.E.T.) Purifier Pre Start Checklist (7/16/93)	6/12/1998		2
1201-0	Blue (A.E.T.) Purifier Cool down & Operating Procedure(7/16/93)	6/11/1998		2
1300-0	Pressure Source to Mole Gas System (5/26/86)	6/17/1998		2
1500-1	80K Helium Pre-Cooler Operating Procedure (7/16/93)	6/12/1998		2
2300-0	Adams Filter Installation Procedure (5/10/02)	5/10/2002		3
2301-0	IB1A Chiller Bay Switchover to Summer Mode (5/14/02)	5/14/2002		2
2400-0	VMTF Cryo Operating Procedure: Refrigerator Mode (5/16/02)	5/16/2002		11
2401-0	VMTF Pre-LN2 Cooldown Checklist (11/23/99)	11/23/1999		1
2402-0	VMTF Pre-LHe Cooldown Checklist (11/23/99)	11/23/1999		1
2403-0	VMTF Overnight Shutdown Checklist (4/10/02)	4/10/2002		1
2404-0	VMTF Pre Warm-up Checklist (11/23/99)	11/23/1999		1
2405-0	VMTF Warm and Secure Checklist (12/10/99)	12/10/1999		2
3000-0	Relief Valve Inspection & Test Procedure (7/16/93)	6/12/1998		8
3002-0	Deadweight Tester weight/psia Value Tester #HL-4488 (7/16/93)	6/17/1998		2
3004-1	Pressure Gauge Calibration Check Record (8/7/92)	6/17/1998		2
3005-0	Building Oxygen Monitor Check Procedure (8/18/92)	6/12/1998		3
3008-2	Pressure Vessel Note Review Backlog (11/16/88)	6/17/1998		2
3008-3	Cold Box HX-1 Code Vessel Status Communication (3/24/84)	6/11/1998		2
3010-0	LOTO Procedure for MTF CTI-1500 Compressor Skid (1/24/02)	1/24/2002	3	8
3010-1	LOTO Procedure for MTF Pressure Vessel (2/19/99)	1/22/2002	3	9
3010-10	LOTO Procedure for hand valves (2/19/99)	1/23/2002	2	2
3010-3	LOTO Procedure: MTF Liquid Ring / Booster Pumps (1/23/02)	1/23/2002	3	9
3010-4	LOTO Procedure: MTF Liquid Ring / Booster Pumps (9/9/02)	9/9/2002	0	8
3010-5	LOTO Procedure for CCI Cold Compressor (10/21/99)	1/24/2002	3	7
3010-7	LOTO Procedure for Adams Automatic Strainer (2/19/99)	1/23/2002	3	7
3010-8	LOTO Procedure for Air Compressor / Dryer (2/19/99)	1/24/2002	3	8
3010-9	Valve Tagouts (1/6/93)	1/06/1993		2
3020-0	CTI 1500 Failure Mode Effects Analysis (10/21/99)	7/03/2002	2	190
4002-0	Stockroom Withdrawal Policy for Chemical Substances (7/22/92)	6/15/1998		2
4004-1	CTI 1500 Operator Training Program (11/14/92)	6/15/1998		4
4004-2	Desired Characteristics for CTI-1500 Operators (7/21/88)	6/15/1998		2
4005-1	MTF Cryo Review Committee Walk Through Report (8/12/92)	6/15/1998		2
4006-0	LOTO Cryo Equipment Review (8/20/92)	6/15/1998		3
4007-0	Visitor Policy (1/13/92)	6/15/1998		2
4008-0	Counterfeit Bolts: Abatement Plan (10/27/92)	6/17/1998		4
4008-1	Counterfeit Bolt Abatement Status 11/23/1992 (11/23/92)	6/17/1998		3
4010-1	CTI 1500 Operations Quarterly Summary: First Quarter (1992)	6/17/1998		3
4010-2	CTI 1500 Operations Quarterly Summary: Second Quarter 1992)	6/17/1998		3
4010-3	CTI 1500 Operations Quarterly Summary: Third Quarter (1992)	6/17/1998		4
4010-4	CTI 1500 Operations Quarterly Summary: Fourth Quarter (1992)	6/17/1998		3
4020-0	MTF Cryogenic Operations Document Policy (9/09/91)	6/15/1998		2
4021-0	MTF Refrigerator Operating Procedures Policy (9/11/91)	6/15/1998		2
4022-0	Logbook Flyleaf Insert Phone reference	6/17/1998		2

MTF-REF #	General Description	Date Entered	Rev. #	# Of Pages
5000-0	Required platform loading calculations for MTF Cold box and Adjacent platforms (8/4/92)	6/17/1998		3
5001-0	Proposed Thermometry upgrade for CTI-1500 Cold box (10/6/92)	6/17/1998		3
5002-0	System Safety Analysis Document Requirements (12/9/92)	6/15/1998		3
5004-0	Proposal to Upgrade LCW System at MTF (5/16/90)	6/17/1998		3
5005-0	Proposal to replace existing LN2 Storage Trailers (5/25/89)	6/17/1998		4
5006-0	IB1A Emergency Ventilation Project (9/16/91)	6/17/1998		3
5007-0	Initial Sketchbook for tandem Cold box/dewar Proposal Utilizing the surplus LBL Equipment (4/3/88)	6/18/1998		3
5008-0	Proposal to replace IB1 House Air Compressor (12/4/87)	6/18/1998		2
5008-1	Proposal for upgrade of MDTF Air Dryer (2/24/87)	6/18/1998		2
5009-0	Self-Actuated Cryogenic transfer Line Safety Valve (3/13/87)	6/18/1998		5
HTS-000228-1	HTS Power Leads in Tev Spool Box (10/4/01)	7/21/1998	A	3
RCU-98-012	MTF Engineering Standard Electrical Standard for Process Controls (5/22/98)	5/22/1998	Draft	8
VPT'S	Procedure for Charging VPTs' (8/25/99)	8/25/1999		1
xxxx-x	CTI 1500 "What If...?" Analysis (8/6/86)	6/24/1998		5

FERMILAB
Technical Division

VMTF Cryogenic Operating Procedures – Refrigerator Mode

Author:	Date:
Reviewed by: Roger Rabehl	Date: 5/16/02
Approved by:	Date:

VMTF Cryogenic Operating Procedures
Refrigerator Mode

version May 16, 2002

1. **Pre-test**
   a) Instrumentation: Perform 4 wire measurement of all thermometers, liquid level gauges with hand held DVM
   b) Dewar checkout: Visual inspection of connections labeling etc. as per system schematic.
   c) Check all insulating vacuums (dewar, transfer lines, etc.) Make a note of them in the VMTF logbook.

2. **Pre cool-down checkout and assembly**
   a) Attach magnet and displacer material to dewar insert as per assembly drawing and procedure.
   b) Measure physical location of thermometers and the upper liquid level probes WRT top hat to nearest 1/8 inch. Remember that the lambda plate will move up a little upon installation; try to estimate how much. Place information about the thermometer and liquid level probe positions in the VMTF log book.
   c) Clean and check the insert top plate O-ring.
   d) Lower top plate with magnet/displacer into dewar.
   e) Bolt insert top plate to dewar top plate.
   f) Connect the following: instrumentation trees, vent lines, LN2 shield and LN2 cool-down line, power lead vent connections.
   g) Establish readout of dewar instrumentation through computer.
   h) Make sure all readings are nominal.
   i) Check valve actuator stroke and operation for EV-2410, 20, and 30 and EV-2411.
   j) Check operation of the Kautzky valves by flipping the switch off on the power panel for the valves. Turn it back on to reclose the valves.
   k) Verify that MV-2467 on the distribution dewar is locked open.
   l) Visually confirm operation of the Ducksucker control valves PCV-2445 and PCV-2446.

3. **Transfer line purge before cooldown**
   a) Crack bayonet ball valve MV-2468 at the transfer line end box to ensure that there is no pressure.
   b) Open MV-331 (hand valve to transfer line above 10,000 liter dewar).
   c) Purge from 10,000 liter dewar through transfer line out at VMTF. through MV-2468 at transfer line end box.
   d) Close MV-331 and MV-2468.

4. **Dewar pump and purge before cool-down**
   a) Close all system valves.
   b) Using the witness marks on the valve stems, visually confirm that the three actuated fill valves EV-2410, EV-2420, and EV-2430 are 100% closed.
   c) If not already installed, install the U-tube and the Z-tube.
   d) Close JT Valve (EV-2420) to isolate the vacuum side of the LHe HX from the balance of Test Dewar.
   e) Repeat the evacuation and purge steps one more time using the backfill system to repressurize the pumping line, then close PCV-2445 and PCV-2446.
   f) Set EV-2411 to "up" position , allowing flow through Lambda plate during purging and throughout cool-down.
   g) Make sure the three-position valve, EV-2417, is set to the external vent position.
   h) Make sure MV-2450, MV-2451, MV-2418, MV-2413, MV-2419, and EV-2416 are closed.
   i) Make sure FCV-2494 and FCV-2432 are closed.
   j) Open the bypass valve MV-2466.
   k) Open EV-2410 and EV-2430.
   l) Open EV-2420, PCV-2445, and PCV-2446. This will pump down the test dewar, the end box, the transfer line, the suction line, the purifier line, the U-tube, the Z-tube, and the Ducksucker pumping line.
   m) Cycle EV-2410, EV-2420, and EV-2430 during the pumpdown.
   n) When the test dewar pressure has stabilized, close PCV-2445 and PCV-2446 to isolate the Ducksucker.
   o) Open MV2497, MV2432, FCV-2432, and FCV-2494 to repressurize the system. Be careful not to overpressurize the vacuum pressure sensors on the heat exchanger/pumping line – they have a range of 0-1000 Torr (0-19.3 psia)
   p) When the system reaches above atmospheric pressure, open MV-2413.
   q) Keep pressurizing the system until the parallel plate SV-2413 relieves. Again be careful not to overpressurize the vacuum pressure sensors.
   r) Close MV-2413, FCV-2432, and FCV-2494.
   s) Repeat steps l-r four more times.
   t) Open GHe Buffer Tank Isolation Valve (MV-2400), and adjust GHe pressure Regulator (PRV 2400) to ~ 5 psig.
   u) Open the Rotometer Valve (FCV-2432).
   v) Open (MV-2495) then open (MV-2492); this should pressurize the Test Dewar.
   w) Open EV-2416 for ~3 minutes to purge out the vent line.
   x) Open in turn, the Power Lead Rotometer Valves (FCV-2450) and (FCV-2451) and the corresponding hand valves (MV-2450 and MV-2451), and set a flow of ~ 20 scfh for ~ 3 minutes each. Reclose MV-2450 and MV-2451.

y) Open the Pressure Block Purge Valves in turn, for ~ 30 seconds each (MV-2410), (MV-2416), (MV-2420), (MV-2440), and (MV-2442).

z) Close (MV-2495), and (MV-2492), and adjust the GHe Regulator (PRV-2400) for 25 psig

aa) Open valve MV-2497 and set the Fairchild GHe Pressure Regulator (PRV-2492) for ~ 1 psig.

bb) Open FCV-2493 and FCV-2494 to maintain a 1 psig positive helium pressure on the dewar.

cc) Set EV-2417 to suction, and open the lead flow valves MV-2450 and MV-2451.

dd) Open MV-2419 to scrub the test dewar. Make sure there is a flow path through the purifier to return to suction (either He dryer valves MV-1902/MV-1916 or MV-1903/MV-1917 must be open, purifier inlet and outlet valves must be open, purifier return to suction valve must be open).

ee) Scrub the test dewar for at least two hours by supplying it through MV-2432/FCV-2432 and EV-2430. Close EV-2410. Take flow through the lead flow valves. Due to the small pressure differential between the test dewar and compressor suction, flow through the leads will not be large enough to read on the rotameters – check the differential pressure gauge on the purifier panel to verify flow.

ff) Dead-head the Ducksucker by closing the valve for return to suction and the valve for venting into the courtyard. Open PCV-2445 to maintain a positive pressure helium atmosphere on the Ducksucker.

gg) After scrubbing, close MV-2419 and MV-2432.

hh) Open the three PHPK valves (EV-2410, 2420, and 2430). They are left open during the 80 K cooldown. The helium via PRV-2492 pressurizes the entire system including the pumping line and Ducksucker.

5. **LN2 cool down of dewar (to about 90 K)**

a) Complete the Pre-LN2 Cooldown Checklist.

b) Open MV-2473 until the LN2 line to the VMTF panel is cold.

c) Open MV-2482, MV-2488, and adjust rotameter FCV-2488 to 180 SCFH for LN2 to 80 K main shield.

d) Open MV-2483, MV-2485, and adjust rotameter FCV-2485 to 80 SCFH for LN2 to 80 K baffle shield.

e) Open MV-2472 and MV-2476 to send LN2 through magnet LN2 heat exchanger. Throttle the heat exchanger flow with MV-2472 to avoid spilling liquid from the vent.

f) Close MV-2473 as much as necessary to keep liquid from spilling out the vent. Leaving MV-2473 cracked open will remove boiloff so that only liquid is sent to the shields.

g) Cycle the three control valves EV-2410, EV-2420, and EV-2430 twice per shift during the LN2 cooldown.

6. **LN2 cool down of transfer line** (Warning: must be done before helium cooldown of the transfer line, or damage to the line may result.)
   a) Open MV-2475 to enable LN2 to transfer line shield.
   b) Open PCV-2470 to establish transfer line LN2 shield flow.
   c) Watch the vent temperature at the far end of the transfer line. The line is cold when the vent is under 120 K. The flow is too large if liquid is spilling out the vent.
   d) Adjust flow with PCV-2470.

7. **LHe cool down of transfer line and morning refill (starting with step i)**
   a) Bring the liquid level in the 10,000 liter dewar up to a normal operating level (nearly full - about 80%).
   b) Set the 10,000 liter dewar pressure at 7 psig.
   c) Close FCV-2403 and FCV-2404 to stop the pressurizing flow to the distribution dewar.
   d) Stop LN2 transfer to LN2 heat exchanger by closing MV-2472.
   e) Purge LN2 heat exchanger line with helium gas for 15 minutes. Leaving the vent valve (MV-2476) open, open MV-2495, MV-2493, and MV-2471. Close MV-2432 and open FCV-2432 100%. Make sure that MV-2474 is closed.
   f) Isolate the LN2 heat exchanger by first closing MV-2476, then MV-2495, MV-2493, and MV-2471.
   g) Complete the Pre-LHe Cooldown Checklist
   h) Open MV-2418.
   i) Open MV-331 (above the 10,000 liter dewar) to equalize the pressures of the distribution dewar and the 10,000 l dewar.
   j) Slowly, incrementally open MV-2466 and control the cooldown flow with MV-2466.
   k) Watch the helium liquid level in the transfer line endbox.

8. **LHe cool down (~90 K to 4.2K helium fill for volumes above/ below lambda plate)**
   a) Check slow monitoring system. Carbon glass thermometers on/near magnet should read 80 to 90 K.
   b) EV-2411 should remain in “up” position , allowing flow through Lambda plate.
   c) Set up for helium transfer as follows.
   d) For the initial cool down, close MV-2466 on the distribution dewar. When refilling in the morning, leave MV-2466 cracked open to avoid sending vapor to the VMTF test dewar.

e) For the initial cool down, set valve EV-2410 at 20% open and EV-2430 100% open for bottom fill. Leave EV-2420 cracked open to help maintain positive pressure in the pumping. When refilling in the morning, open EV-2410 to 100% open. Leave EV-2420 cracked open and EV-2430 0% open. Run in this configuration to cool the U-tube and Z-tube until the TeCgDeAlM_1 reading begins to drop. At this point, set valve EV-2410 at 20% open and EV-2430 100% open for bottom fill. Leave EV-2420 cracked open.

f) Close MV-2497; pressurizing flow to dewar is stopped. Also close FCV-2494 and FCV-2493.

g) If subcooled operation is planned, close PCV-2445.

h) Vent all helium out the power leads and bypass valve EV2416.

i) Vent the boiloff outside through EV-2417 for 5-10 minutes, then switch EV-2417 back to suction. Watch refrigerator contamination levels.

j) If contamination levels are low (a few ppm and dropping), continue to take boiloff directly back to suction through MV-2418. Otherwise set EV-2417 to outside vent for a few more minutes and repeat.

k) Monitor the transfer using the liquid level gauges and thermometer.

l) When the liquid level starts to appear above the lambda-plate, close EV-2420 (the 2 K JT).

m) Continue filling up to 8 cm above the lambda plate.

9. **4.2 K operation**

a) With 8 cm of liquid above the lambda plate, close EV-2430 and open EV-2410 for top fill.

b) Vent all helium out the power leads.

c) Activate PID loop for 10 cm liquid level at power leads with valve EV-2410. Hold 10 cm of liquid for non-power testing and 20 cm for power testing.

d) Leave EV-2411 open during 4.2 K testing.

e) Leave EV-2420 (2 K JT) closed during 4.2 K testing, with ½ psig pressure on the pumping line via PRV-2447 and MV-2448.

f) Valves PCV-2445 and PCV-2446 (to the Ducksucker) should be closed.

10. **Quench recovery at 4.2 K**

a) Kautzky valves (KSV-2415 and KSV-2417) automatically open at about 10 psig and reclose when pressure above the lambda plate comes back down to 7 psig.

b) Leave top-fill valve (EV-2410) in automatic with a 20 cm set point.

11. **Cool-down to 3.0 K (180 torr) K**.

a) Leave EV-2411 open.

b) Set the Ducksucker to vent outside.

c) Turn on the liquid ring pump (leave booster off) with PCV-2445 and PCV-2446 initially closed. Pump through PCV-2445, opening it slowly at first, and bring the pressure into PCV-2445 (which is PI-2444 or PrWtPiPuM_1) down to about 350 torr. PCV-2446 can be partially opened to speed up the pump down of the line.

d) Open EV-2420 to 40% watching PI-2444 since this will give gas to the pump. Do not overfill the heat exchanger.

e) Open the big valve into the pump (PCV-2446) 100% open. Any remaining liquid (as indicated by level) in the heat exchanger will go away.

f) Open EV-2420 about 3 % at a time to about 52% open. Take liquid off the top of the lambda plate via EV-2420 as fast as the top-fill valve (EV-2410) can add it back at 100% open. Take care not to overfill the heat exchanger.

g) Put EV-2410 into automatic mode with a setpoint of 20 cm. Using EV-2420, supply liquid to the heat exchanger at a rate that maintains 10 cm above the lambda plate. As the delta-T to the heat exchanger from the bath decreases, the rate of boiloff will decrease, and the liquid level in the heat exchanger will start to recover.

h) After venting the Ducksucker outside for about an hour, begin taking the Ducksucker flow back to suction. If contamination does not significantly decrease within 15 minutes, vent outside for another 30 minutes before returning to suction.

i) The liquid ring pump alone can cool VMTF to about 3.0 K. If cooling down to less than 3.0 K, skip to #12 below.

j) When the heat exchanger liquid level reaches the upper probe, or about 150 cm from the top, start cutting back the position of EV-2420 (2 K JT) 5% at a time, allowing the recovery of pressure to the desired level by closing down PRV-2446 between moves. Use care not to allow the heat exchanger liquid level to overfill, since this results in odd pressure and temperature excursions that will slow the cooldown.

k) EV-2420 will be about 15% open when a steady liquid level and temperature are attained.

l) Control EV-2420 to maintain a heat exchanger liquid level within 100 cm of the top, and control temperature by means of PCV-2445 (the small valve into the pumps).

12. **Cool-down to sub-lambda from 3.0 K.**

a) Close PCV-2445 and PCV-2446 when there are more than 100 cm of liquid in the heat exchanger. (This should be at around 3.0 K.)

b) Turn on the booster pump.

c) Open PCV-2445, then PCV-2446 slowly to 100% to bring the pumping line pressure down to 35 torr. Note: the liquid level probe in the heat exchanger will not show a true level between 60 torr and 35 torr.

d) The liquid level in the heat exchanger will again drop way down. Open EV-2420 to about 50% open, as much as it can be opened with EV-2410 at 100% and the liquid level between 10 cm and 14 cm above the lambda plate.
e) Close EV-2411 at 2.2 K.
f) As the delta-T between the heat exchanger and bath reduces, liquid level in the heat exchanger will recover. When it reaches the upper probe, or 150 cm from the top, begin cutting back EV-2420 5% at a time.
g) Close PCV-2446 between moves of EV-2420 to maintain the desired pressure (for example, 17 torr for 1.90 K) at the heat exchanger.
h) When equilibrium is reached, EV-2420 will be down to about 15% open and PCV-2446 will be at about 20% open to control temperature.

13. **Cool-down to a sub-lambda-point temperature from around 2.5 K (80 torr) or lower.**
a) When starting in the morning with the system off, shut down the purge flow into the dewar and top fill (via EV-2410) up to 14 cm. Note: In order to avoid cryopumping dirty gas into the JT heat exchanger, do not start pumping on the heat exchanger until liquid is at 10 cm or more above the lambda plate.
b) If the top of liquid is below the lambda plate, bottom fill until the temperature below the lambda plate indicates liquid temperature. Then go to top filling; we want to add as little warm liquid under the lambda plate as possible. During refilling, crack open the distribution dewar bypass valve MV-2466 to avoid sending vapor to the VMTF test dewar.
c) Make sure the Ducksucker is set to initially vent outside, and make sure that PCV-2445 and PCV-2446 are closed. Turn on the liquid ring pump and booster pump.
d) Open PCV-2445, then PCV-2446 slowly to bring the pumping line pressure down to 50 torr. Note: the liquid level probe in the heat exchanger will not show a true level between 60 torr and 35 torr.
e) Watch the liquid level in the heat exchanger to see if it responds. It should go down. (If there is no response, the liquid level probe might not be working, in which case pump the heat exchanger dry. It is dry when the pressure in at the heat exchanger is less than 3 torr. One can then check that the probe reads zero with no liquid before slowly adding liquid.)
f) Open PCV-2446 (the big valve) as far as possible without tripping off the blower. Note 1: the booster pump trips off at about 50 torr, so if the temperature of the liquid is at or below 2.3 K (50 torr), the pump valves (PCV-2445 and PCV-2446) can be opened slowly to 100%. Note 2: the liquid level probe in the heat exchanger will not show a true level between 60 torr and 35 torr.
g) Open EV-2420 to about 50% open, as much as it can be opened with EV-2410 at 100% and the liquid level between 10 cm and 14 cm above the lambda plate.

h) As the delta-T between the heat exchanger and bath reduces, liquid level in the heat exchanger will recover. When it reaches the upper probe, or 150 cm from the top, begin cutting back EV-2420 5% at a time in order not to overfill the heat exchanger.

i) When the desired temperature (such as 1.9 K) is reached, close EV-2420 to about 15% open and PCV-2446 to about 25% open to hold steady temperatures.

14. **Quench recovery at 1.9 K.**

a) Open PCV-2446 (the large pump valve) to 100%.

b) Open EV-2420 (the heat exchanger supply) to about 35%.

c) Hold these positions to 1.9 K. Then

d) Close PCV-2446 to 25%.

e) Close EV-2420 to 15%.

f) Note: at 1.9 K for quench recovery there is no need to open any vents from above the lambda plate.

15. **Operation at 4.5 K (higher than atmospheric pressure)**

a) Control dewar pressure by closing down on the power lead flow at the two rotameters. Choose a pressure to correspond to the desired temperature, e.g., 4.4 psig (18.9 psia) for 4.50 K. The lead flow will be 250 to 300 SCFH each.

b) Stop the transfer of liquid to the dewar by closing the top fill valve (EV-2410) and closing MV-331.

c) Open the bottom-fill valve 100% (EV-2430).

d) Open MV-2432.

e) Set up a warm helium flow of 40 SCFH air on FCV-2432. This will enter via the bottom-fill valve and bubble into VMTF, warming VMTF from the bottom and providing a higher, uniform temperature.

f) Reduce the warm flow to 20 SCFH air when the temperatures all come to saturation (corresponding to the pressure above the lambda plate).

g) Adding the gas and warming will hold the liquid level on the power leads until warm-up is complete.

h) After warm-up is complete, the magnet should be quenched or top-filling resumed to hold the liquid level. If top-filling is resumed, close MV-2432, but maintain the pressure in the dewar with current lead flow controls.

i) If filling is resumed after MV-331 has been closed for a while, precool the transfer line via MV-2466 and watch for liquid in the end box before opening the dewar top or bottom fill valves.

16. **Warm up from liquid helium temperature to room temperature**

a) Complete the Pre-Warmup Checklist.

b) Prior to starting warm-up, verify that the slow monitoring system is fully operational. Record status of liquid level gages and thermometers in log book (print out results of slow monitor scan from DAQ).

c) Open the lambda plate check valve EV-2411.

d) Close the transfer line LN2 supply valve MV-2475.

e) If RRR measurements are not going to be taken, turn off the LN2 shields by closing MV-2482 and MV-2483. If RRR measurements are going to be taken, leave the LN2 shields on.

f) Open the bottom fill valve EV-2430 100% in manual mode.

g) Open MV-2432.

h) Open the dewar bypass valve EV-2416 100 %.

i) Slowly open rotameter FCV-2432 to no more than 10 scfh air while maintaining a test dewar pressure of no more than 5 psig as read on PI-2490 at the VMTF valve panel. Verify that compressor suction is not higher than 21 psia (estimated; operator's discretion) as read on the refrigerator controls PC.

j) Continue to monitor the test dewar LHe level, the test dewar pressure, and compressor suction. If conditions are stable after 15 minutes, flow through FCV-2432 can be slowly increased by 5 scfh while carefully monitoring test dewar pressure and compressor suction.

k) Step i can be repeated until the test dewar is empty of liquid.

l) If RRR measurements are going to be taken, stop helium flow to the test dewar when the magnet temperature reaches 9 K. Stop at this point until measurements are completed. After the RRR measurements are completed, , turn off the LN2 shields by closing MV-2482 and MV-2483.

m) When the test dewar is empty of liquid, take as much flow as possible through FCV-2432 while maintaining compressor suction no higher than 21 psia (estimated; operator's discretion) as read on the refrigerator controls PC.

n) Turn off the superconducting liquid level probes.

o) Maintain this flow until magnet temperatures are 70-80 K.

p) When magnet temperatures are 70-80 K, helium gas may be put into the clamshell. First close MV-2432, then open MV-2476, MV-2495, MV-2493, and MV-2471. Watch FCV-2432 for flow. If there is flow, continue flowing helium gas for 10 minutes.

q) After 10 minutes of helium flow, the clamshell may be changed over to nitrogen gas flow. Close FCV-2432, MV-2432, MV-2495, and MV-2493. Open MV-2474 and the clamshell warmup gas rotameter FCV-2465 as much as possible.

r) Continue flowing helium gas into the test dewar through FCV-2432 and MV-2432.

s) If it is desired to speed the warmup only if the magnet is going to be pulled from the test dewar after warming and especially if there is no clamshell heat exchanger on the magnet, GN2 can be introduced into the test dewar once all temperatures are at least 150 K. Close FCV-2432 to stop the GHe flow. Switch EV-2417 to outside vent, and close EV-2418 to isolate the compressors. Make sure MV-2492 is closed. Open MV-2474, MV-2493, and MV-2495. When rotameter FCV-2465 is opened, GN2 flow will be pushed through the bottom fill valve EV-2430 into the test dewar. If there is no flow check the status of GN2 supply valves MV-2464, PRV-2462, and MV-2462.

t) Complete the Warm/Secure Checklist before opening the test dewar.

u) Close valves EV-2430 and EV-2416.

17. **Overnight condition**

a) Before shutting down the Ducksucker, fill the heat exchanger to the normal operating level.

b) When the Ducksucker is shut down for overnight running, close EV-2420, open MV-2448, and put about 1 psig positive helium pressure on the pumping line via the pressurization system with PRV-2447, FCV-2447, and FCV-2448 near the Ducksucker.

c) Dead-head the Ducksucker by closing the valve for return to suction and the valve for venting into the courtyard.

d) Leave PCV-2445 open to maintain a positive pressure helium atmosphere in the Ducksucker.

e) When the transfer is stopped for overnight, close EV-2416, open MV-2497, and put about 1 psig positive helium pressure on the dewar via the pressurization system with PRV-2492, FCV-2493, and FCV-2494 at the dewar.

f) Keep EV-2417 switched to suction.

g) Close MV-331 above the 10,000 l dewar, open bypass valve MV-2466 on the distribution dewar, and leave the top fill valve EV-2410 cracked open to minimize the pressure difference across the bottom fill valve EV-2430.

h) Do not open the lambda plate check valve EV-2411 after 1.9 K operation (the lambda plate check valve is always open during 4.2 K operation).

i) Complete the Overnight Shutdown Checklist.

FERMILAB Technical Division	VMTF Pre-LN2 Cooldown Checklist	Doc. No. Rev. No. 0 Date: November 23, 1999 Page 1 of 1

last revised: 991123 RJR
reviewed & approved:

VMTF PRE-LN2 COOLDOWN CHECKLIST
MAGNET # HFDB02

INITIALS

___ 1) DUCKSUCKER IS DEAD-HEADED.

___ 2) DUCKSUCKER CONTROL VALVE PCV-2446 OPEN.

___ 3) TEST DEWAR FILL VALVES EV-2410, 2420, AND 2430 OPEN.

___ 4) LEAD FLOW VALVES MV-2450 AND MV-2451 OPEN.

___ 5) 3-WAY VALVE EV-2417 SET TO SUCTION.

___ 6) SUCTION VALVE EV-2418 CLOSED.

___ 7) PURIFIER VALVE MV-2419 CLOSED.

___ 8) TEST DEWAR KAUTZKY VALVES KSV-2415 AND KSV-2417 CLOSED.

___ 9) MV-2413 LEADING TO TEST DEWAR PARALLEL PLATE RELIEF CLOSED.

___ 10) TEST DEWAR BYPASS VALVE EV-2416 CLOSED.

___ 11) THE FOLLOWING WARM GAS VALVES ARE CLOSED:

- ___ a) GHE: MV-2432, MV-2492, MV-2493, MV-2495
- ___ b) GN2: MV-2474
- ___ c) GHE/GN2: MV-2471

___ 12) POSITIVE PRESSURE BEING MAINTAINED IN TEST DEWAR BY MV-2497, PRV-2492, FCV-2493, AND FCV-2494.

NOTES: _____

DUTY OPERATOR: _____ DATE/TIME: 05-08-02

FILE/REVIEW BY CRYO-SYSTEM MGR. _____ DATE: 05/16/02

FERMILAB Technical Division	**VMTF** **Pre-LHe Cooldown Checklist**	**Doc. No.** **Rev. No. 0** **Date: November 23, 1999** **Page 1 of 1**

last revised: 991123 RJR
reviewed & approved:

VMTF PRE-LHE COOLDOWN CHECKLIST
MAGNET # HFDB02

INITIALS

GK 1) CLAMSHELL LN2 SUPPLY VALVE MV-2472 CLOSED.

GK 2) GN2 CIRCUIT ISOLATED: MV-2474 CLOSED.

GK 3) CLAMSHELL HEAT EXCHANGER PURGED WITH GHE.

GK 4) CLAMSHELL GAS SUPPLY VALVE MV-2471 CLOSED.

GK 5) GHE CIRCUIT ISOLATED: FCV-2432, MV-2432, MV-2492, MV-2493 AND MV-2495 CLOSED.

GK 6) LN2 COOLDOWN OF TRANSFER LINE FROM STORAGE DEWAR COMPLETED.

NOTES: _____

DUTY OPERATOR: G. KIRSCHBAUM DATE/TIME: 05·09·02 0623

FILE/REVIEW BY CRYO-SYSTEM MGR. _____ DATE: 05·09·02

FERMILAB Technical Division	VMTF Overnight Shutdown Checklist	Doc. No. Rev. No. 1 Date: APRIL 10, 2002 Page 1 of 1

last revised: 020410 GWK
reviewed & approved: 020410 RJR

VMTF OVERNIGHT SHUTDOWN CHECKLIST
MAGNET # HFDB02

INITIALS

____ 1) LHE TRANSFER STOPPED (STINGER REMOVED IF OPERATING IN PORTABLE DEWAR MODE, MV-331 CLOSED IF OPERATING IN REFRIGERATOR MODE).

____ 2) TEST DEWAR FILL VALVES EV-2420 AND EV-2430 CLOSED.

____ 3) DISTRIBUTION DEWAR BYPASS VALVE MV-2466 OPEN.

____ 4) SUCTION VALVE EV-2418 OPEN.

____ 5) TOP FILL VALVE EV-2410 CRACKED OPEN.

____ 6) TEST DEWAR BYPASS VALVE EV-2416 CLOSED.

____ 7) LEAD FLOW VALVES MV-2450 AND MV-2451 AND ROTAMETERS FCV-2450, FCV-2451, FCV-2452, AND FCV-2453 OPEN.

____ 8) EV-2417 SET SUCTION.

____ 9) DUCKSUCKER/PUMPING LINE BACKFILL STATION ON.

____ 10) DUCKSUCKER DEAD-HEADED.

____ 11) POSITIVE PRESSURE BEING MAINTAINED IN TEST DEWAR BY MV-2497, PRV-2492, FCV-2493, AND FCV-2494.

NOTES: _____

DUTY OPERATOR: _____ DATE/TIME: 5-10-02

FILE/REVIEW BY CRYO-SYSTEM MGR. _____ DATE: 5-10-02

FERMILAB Technical Division	VMTF Pre-Warmup Checklist	Doc. No. Rev. No. 0 Date: November 23, 1999 Page 1 of 1

last revised: 991123 RJR
reviewed & approved:

VMTF PRE-WARMUP CHECKLIST
MAGNET # HFDB C2

INITIALS

___ 1) LHE TRANSFER STOPPED (STINGER REMOVED IF OPERATING IN PORTABLE DEWAR MODE, MV-331 CLOSED IF OPERATING IN REFRIGERATOR MODE).

___ 2) LN2 SUPPLY VALVE MV-2472 CLOSED.

___ 3) GHE SUPPLY VALVES FCV-2432, MV-2432, MV-2495, MV-2492, AND MV-2493 CLOSED.

___ 4) GN2 SUPPLY VALVE MV-2474 AND SUPPLY ROTAMETER FCV-2465 CLOSED.

___ 5) TEST DEWAR VENT OPEN. EITHER:

___ a) EV-2417 SET TO SUCTION WITH EV-2418 OPEN, OR

___ b) ~~EV-2417 SET TO OUTSIDE VENT~~.

___ 6) LEAD FLOW VALVES MV-2450 AND MV-2451 FULLY OPEN.

___ 7) LEAD FLOW ROTAMETERS FCV-2450, FCV-2451, FCV-2452, AND FCV-2453 FULLY OPEN.

___ 8) TEST DEWAR FILL VALVES EV-2410, EV-2420, AND EV-2430 CLOSED.

NOTES: _____

DUTY
OPERATOR: _____ DATE/TIME: 5-11-02 2012

FILE/REVIEW BY CRYO-SYSTEM
MGR. _____ DATE: 05.14.02

FERMILAB Technical Division	VMTF Warm/Secure Checklist	Doc. No. Rev. No. 0 Date: November 23, 1999 Page 1 of 1

last revised: 991210 RJR
reviewed & approved:

VMTF WARM/SECURE CHECKLIST
MAGNET # AFBD-02

INITIALS

___ 1) NO ADDIITONAL WARM MEASUREMENTS OR TESTS ARE REQUIRED.

___ 2) TEMPERATURES DISPLAYED ON VMTF OVERVIEW ARE 290 K OR ABOVE:

___ a) ABOVE LAMBDA PLATE TEMPERATURE = out of Range K

___ b) BELOW LAMBDA PLATE TEMPERATURE = 290° K

___ c) MAGNET TOP TEMPERATURE = 290° K

___ d) MAGNET BOTTOM TEMPERATURE = 293 K

___ e) DISPLACER BOTTOM = 295 K

___ 3) THE FOLLOWING WARM GAS VALVES ARE CLOSED:

___ a) GHE: MV-2432, MV-2492, MV-2493, MV-2495, MV-2497

___ B) GN2: MV-2474

___ C) GHE/GN2: MV-2471

___ 4) RETURN TO SUCTION VALVE EV-2418 CLOSED.

___ 5) DISTRIBUTION DEWAR BYPASS MV-2466 CLOSED.

___ 6) 3-WAY VALVE EV-2417 SET TO OUTSIDE VENT.

___ 7) TEST DEWAR IS AT ATMOSPHERIC PRESSURE.

NOTES: _____

DUTY OPERATOR: _____ DATE/TIME: 05-14-02

FILE/REVIEW BY CRYO-SYSTEM MGR. _____ DATE: 05-14-02

Maintenance Log - Frequency =Water/monthy

General Description	Date	Hours On Equipment	Technician	Notes

Device: **LCW water pumps (4)** approximate time

PartName:	LCW water pumps (4)					pumps greased 12-28-99	9/18/2000
Operation:	grease					pumps greased 02-02-00	8/14/2001
Frequency:	monthly				30 minuts no loto needed	pumps greased 04-03-00	

Device: **Glycol System** approximate time

PartName:	glycol pumps (2)					pumps greased 12-28-99	greased 07-12-00	1/1/2002
Operation:	grease					pumps greased 02-02-00	9/18/2000	4696 hrs
Frequency:	monthly				30 minuts no loto needed	pumps greased 04-03-00	8/14/2001	2nd time

Glycol leak repaired in flow system 06/20/00
Glycol leak repaired in flow system 07-12-00

Maintenance Log - Frequency = **By Hours of Operation**

General Description	Date	Hours On Equipment	Technician	Notes
Device: **Compressor Skid**				approximate time
PartName: 200 HP Motor Bearing Operation: Grease Frequency: 2000 Hours				10 min
PartName: 1000HP Motor Bearing Operation: Grease Frequency: 2000 Hours				10 min
PartName: H2O Pump/#1 Bearing Operation: Grease Frequency: 1000 Hours				10 min
PartName: H2O Pump/#2 Bearing Operation: Grease Frequency: 1000 Hours				10 min
Device: **Compressor Skid**				
PartName: 200 HP Motor Bearing Operation: Grease Frequency: 2000 Hours				
PartName: 1000HP Motor Bearing Operation: Grease Frequency: 2000 Hours				
PartName: H2O Pump/#1 Bearing Operation: Grease Frequency: 1000 Hours				
PartName: H2O Pump/#2 Bearing Operation: Grease Frequency: 1000 Hours				
Device: **Compressor Skid**				
PartName: 200 HP Motor Bearing Operation: Grease Frequency: 2000 Hours				
PartName: 1000HP Motor Bearing Operation: Grease Frequency: 2000 Hours				
PartName: H2O Pump/#1 Bearing Operation: Grease Frequency: 1000 Hours				
PartName: H2O Pump/#2 Bearing Operation: Grease Frequency: 1000 Hours				

Maintenance Log - Frequency = **Day / Week**

General Description		Date	Hours On Equipment	Technician	Notes	
Device:	**8" ICW Strainers (2)**				approximate time	
PartName:	8" ICW Strainers (2)					
Operation:	Remove / Clean					
Frequency:	Weekly				1 hour no loto needed	
Device:	**L.R. Pump ICW Filters**					
PartName:	Filters					
Operation:	Replace(varies w/ use)					
Frequency:	Weekly				30 min	
Device:	**N2 Spectrograph Detector**					
PartName:	Detector					
Operation:	Calibrate / Zero					
Frequency:	Daily				30 min	
Device:	**Van Air Pre-Filter, After-Filter, Oil Scrubber**					
PartName:	Van Air					
Operation:	Drain Water					
Frequency:	Daily/Weekly				15 min	
Device:	**Air Reservoir, Aftercooler**					
PartName:						
Operation:	Drain Water					
Frequency:	Daily/Weekly				15 min	
Device:	**8" ICW Strainers (2)**					
PartName:	8" ICW Strainers (2)					Strainers cleaned 12-28-99
Operation:	Remove / Clean					
Frequency:	Weekly					
Device:	**L.R. Pump ICW Filters**					
PartName:	Filters					
Operation:	Replace(varies w/ use)					
Frequency:	Weekly					
Device:	**N2 Spectrograph Detector**					
PartName:	Detector					
Operation:	Calibrate / Zero					
Frequency:	Daily					
Device:	**Van Air Pre-Filter, After-Filter, Oil Scrubber**					
PartName:	Van Air					
Operation:	Drain Water					
Frequency:	Daily/Weekly					
Device:	**Air Reservoir, Aftercooler**					
PartName:						
Operation:	Drain Water					
Frequency:	Daily/Weekly					

CTI Lhe Compressor

Device: **Compressor Skid - 1st Stage**

PartName:	Intake Strainer		
Operation:	Clean		
Frequency	As Required		10 to 16 hour loto needed

Device: **Compressor Skid - 2nd Stage**

PartName:	Intake Strainer		
Operation:	Clean		
Frequency	As Required		10 to 16 hour loto needed

Device: **Compressor Skid**

PartName:	Charcoal Absorber			12/28/1999
Operation:	Change Charcoal			
Frequency	As Required		10 to 16 hour loto needed	

Device: **Compressor Skid**

PartName:	200 HP Motor Bearing			12/28/1999	4/3/2000	8/14/2001	01/01/02
Operation:	Grease						
Frequency	2000 Hours		Aprox time 10 min				

PartName:	1000HP Motor Bearing			12/28/1999	4/3/2000	8/14/2001	1/1/2002
Operation:	Grease						Pilot valve replaced
Frequency	2000 Hours		Aprox. Time 10 min				on 1khp compressor

Infor for these pumps is located under Glycol Pumps

PartName:	H2O Pump/#1 Bearing				
Operation:	Grease				
Frequency	1000 Hours				10 min
PartName:	H2O Pump/#2 Bearing				
Operation:	Grease				
Frequency	1000 Hours				10 min

Charcoal changed 12-28-99
1st stage hrs 5927/ 2nd stage hrs 6569
*charcoal smelled of LB 165 but was dry to touch
200hp motor greased /5927 hrs-due 7927 (@mid june) greased 9-18-00 8/14/2001
1000hp motor greased /8774 hrs- due 10774 (@mid june) greased 9-18-00 8/14/2001

oil filters for both 1st and 2nd stages changed at this time ((should be done every 3 months or if pressure drop is greater than 20 lbs) due @april

NOTE* 1st stage hr meter is not working

Leaking sight glass removed from oil transfer line 06/20/00

Maintenance Log Sullair Air Compressor #1

PartName:	Oil, Filter, Radiator		11/8/1999			6/12/2000	9/22/2000	8/14/2001	4/1/2002	
Operation:	Change, Wash		41556 hrs			43429 hrs	9/22/2000	8/14/2001	52467 hrs	
Frequency	3 Months	4.5 hour Need loto					44245 hrs	49287	new sight glass installe	

PartName:	Motor		12/28/1999	2/2/2000	4/3/2000	9/18/2000	8/14/2001
Operation:	grease				not running		
Frequency	monthly	.5hrs	No loto				

PartName:	Mist Seperator	
Operation:	Change	
Frequency	6 months	2.5 hour Need loto

Compressor Actuators

Actuator#1

Replaced large spur gear, part# G83-40 and small spur gear, part#G83-20.
Replaced all 4 switches, part#V3L-300-D8. Also replaced the break assembly.(07-10-2002)
Status: Will be kept in cabinet in the compressor building as a spare

Actuator#2

Status: Currently on first stage 7/12/2002

Actuator#3

Status: Currently on second stage 7/12/2002

Maintenance Log - Frequency = 1 **Month**

General Description	Date	Hours On Equipment	Technician	Notes
Device: **Compressor Skid**				
PartName: Balston Oil Removers Operation: Blow Down Frequency: 1 Month				
PartName: Charcoal Absorber Operation: Blow Down 1/4" Vlve. Frequency: 1 Month				
PartName: Final Filter Operation: Blow Down 1/4" Vlve. Frequency: 1 Month				
PartName: 1/4" Vlve. Before Final Operation: Sample Frequency: 1 Month				
Device: **Scram Packs**				
PartName: Scram Packs Operation: Inspect Frequency: 1 Month				
Device: **Building O2 Sensor Heads**				
PartName: Building O2 Heads Operation: Test & Inspect Frequency: 1 Month				
Device: **Compressor Skid**				
PartName: Balston Oil Removers Operation: Blow Down Frequency: 1 Month				
PartName: Charcoal Absorber Operation: Blow Down 1/4" Vlve. Frequency: 1 Month				
PartName: Final Filter Operation: Blow Down 1/4" Vlve. Frequency: 1 Month				
PartName: 1/4" Vlve. Before Final Operation: Sample Frequency: 1 Month				
Device: **Scram Packs**				
PartName: Scram Packs Operation: Inspect Frequency: 1 Month				
Device: **Building O2 Sensor Heads**				
PartName: Building O2 Heads Operation: Test & Inspect Frequency: 1 Month				

Maintenance Log - Frequency = **3 Months**

General Description		Date	Hours On Equipment	Technician	Notes
Device:	**Blue Purifier**				approximate time
PartName:	Absorber Pots				
Operation:	Warm & De-Rime				
Frequency:	3 Months				1.5 hr set up time 48 hr De-Rime
Device:	**Green Purifier**				
PartName:	Absorber Pots				
Operation:	Warm & De-Rime				
Frequency:	3 Months				1.5 hr set up time 48 hr De-Rime
Device:	**Sullair Air Compressor 1**				
PartName:	Oil, Filter, Radiator				
Operation:	Change, Wash				
Frequency:	3 Months				4.5 hour loto needed
Device:	**Sullair Air Compressor 2**				
PartName:	Oil, Filter, Radiator				oil + filter changed 12-28-99 38679 hrs 4/8/2002
Operation:	Change, Wash				air compressor terminated wire for lead and lag 48410 hrs
Frequency:	3 Months				4.5 hour loto needed
Device:	**Personal O2 Monitors**				
PartName:	Cells, Batteries				
Operation:	Re-calibrate, Replace				
Frequency:	3 Months				6.0 hour
Device:	**Compressor skid**				
PartName:	Oil Filter				
Operation:	Change				
Frequency:	3 Months				3.0 hr no loto needed
Device:	**Blue Purifier**				
PartName:	Absorber Pots				
Operation:	Warm & De-Rime				
Frequency:	3 Months				
Device:	**Green Purifier**				
PartName:	Absorber Pots				
Operation:	Warm & De-Rime				
Frequency:	3 Months				
Device:	**Sullair Air Compressor 1**				
PartName:	Oil, Filter, Radiator				
Operation:	Change, Wash				
Frequency:	3 Months				
Device:	**Sullair Air Compressor 2**				
PartName:	Oil, Filter, Radiator				
Operation:	Change, Wash				
Frequency:	3 Months				
Device:	**Personal O2 Monitors**				
PartName:	Cells, Batteries				
Operation:	Re-calibrate, Replace				
Frequency:	3 Months				
Device:	**Compressor skid**				
PartName:	Oil Filter				
Operation:	Change				
Frequency:	3 Months				

Maintenance Log - Frequency = **6 Months**

General Description	Date	Hours On Equipment	Technician	Notes
Device: **Edwards Chiller**				approximate time
PartName: Filters Operation: Check / Replace Frequency: 6 Months				1 hour
Device: **Safety Eye Wash**				
PartName: Water Operation: Drain, Clean, Refill Frequency: 6 Months				1 hour
Device: **Cold Box**				
PartName: D. Pump Rougher Operation: Oil Change/Belts Frequency: 6 Months				1 hour
Device: **Distribution Box**				
PartName: Turbo Rougher Operation: Oil Change/Belts Frequency: 6 Months				1 hour
Device: **Edwards Chiller**				
PartName: Filters Operation: Check / Replace Frequency: 6 Months				
Device: **Safety Eye Wash**				
PartName: Water Operation: Drain, Clean, Refill Frequency: 6 Months				
Device: **Cold Box**				
PartName: D. Pump Rougher Operation: Oil Change/Belts Frequency: 6 Months				
Device: **Distribution Box**				
PartName: Turbo Rougher Operation: Oil Change/Belts Frequency: 6 Months				

Maintenance Log - Frequency = **1 Year / 6 Year**

General Description	Date	Hours On Equipment	Technician	Notes
Device: **House Air Dryers**				approximate time
PartName: Activated Alumna Operation: Change Frequency: 1 Year				4 to 6 hour loto needed
Device: **Cold Box**				
PartName: Diffusion Pump Operation: Change Oil Frequency: 1 Year				1 hour
Device: **Compressor Skid**				
PartName: Compressor Oil Operation: Sample For Analysis Frequency: 1 Year				
Device: **House Air Dryers**				
PartName: Activated Alumna Operation: Change Frequency: 1 Year				
Device: **Cold Box**				
PartName: Diffusion Pump Operation: Change Oil Frequency: 1 Year				
Device: **Compressor Skid**				
PartName: Compressor Oil Operation: Sample For Analysis Frequency: 1 Year				
Device: **House Air Dryers**				
PartName: Activated Alumna Operation: Change Frequency: 1 Year				
Device: **Cold Box**				
PartName: Diffusion Pump Operation: Change Oil Frequency: 1 Year				
Device: **Compressor Skid**				
PartName: Compressor Oil Operation: Sample For Analysis Frequency: 1 Year				
Device: **Relief Valves**				
PartName: Relief Valves Operation: Test Set Pressure Frequency: 6 Years				

Maintenance Log - Frequency = **As Required**

General Description	Date	Hours On Equipment	Technician	Notes
Device: Edwards Chiller				approximate time
PartName: Chiller Operation: Service Call Frequency: As Required				
Device: Trane Chiller				
PartName: Chiller Operation: Service Call Frequency: As Required				
Device: Adams Strainer				
PartName: Tubes Operation: Remove / Clean Frequency: As Required	03-20-02		GWK	NEW ADAMS FILTER INSTALLED. 6 hour loto needed
Device: De-Ionizer Bottles				
PartName: Bottles Operation: Change when < 10mO Frequency: As Required				1 hour
Device: Gauges				
PartName: Gauges Operation: Calibrate - Deadweight Frequency: As Required				
Device: Building O2 Sensor Heads				
PartName: Sensor Heads Operation: Replace & Return Frequency: As Required				2 hour
Device: Compressor Skid - 1st Stage				
PartName: Intake Strainer Operation: Clean Frequency: As Required				10 to 16 hour loto needed
Device: Compressor Skid - 2nd Stage				
PartName: Intake Strainer Operation: Clean Frequency: As Required				10 to 16 hour loto needed
Device: Compressor Skid				
PartName: Charcoal Absorber Operation: Change Charcoal Frequency: As Required				10 to 16 hour loto needed

Maintenance Log - Frequency = **By Hours of Operation**

General Description	Date	Hours On Equipment	Technician	Notes
Device: Compressor Skid				approximate time
PartName: 200 HP Motor Bearing Operation: Grease Frequency: 2000 Hours	01-2002		GWK	10 min
PartName: 1000HP Motor Bearing Operation: Grease Frequency: 2000 Hours	01-2002		GWK	Pilot valve Replaced on 1,000 HP Compr 10 min
PartName: H2O Pump/#1 Bearing Operation: Grease Frequency: 1000 Hours	01-2002	4694 2nd time	GWK	10 min
PartName: H2O Pump/#2 Bearing Operation: Grease Frequency: 1000 Hours	01-2002	4694 2nd time	GWK	10 min
Device: Compressor Skid				
PartName: 200 HP Motor Bearing Operation: Grease Frequency: 2000 Hours	07-12 2002		[illegible]	
PartName: 1000HP Motor Bearing Operation: Grease Frequency: 2000 Hours	07-12 2002		[illegible]	
PartName: H2O Pump/#1 Bearing Operation: Grease Frequency: 1000 Hours	7-12 2002		[illegible]	
PartName: H2O Pump/#2 Bearing Operation: Grease Frequency: 1000 Hours	7-12 2002		[illegible]	
Device: Compressor Skid				
PartName: 200 HP Motor Bearing Operation: Grease Frequency: 2000 Hours				
PartName: 1000HP Motor Bearing Operation: Grease Frequency: 2000 Hours				
PartName: H2O Pump/#1 Bearing Operation: Grease Frequency: 1000 Hours				
PartName: H2O Pump/#2 Bearing Operation: Grease Frequency: 1000 Hours				

Maintenance Log - Frequency = **Day / Week**

General Description	Date	Hours On Equipment	Technician	Notes
Device: 8" ICW Strainers (2)				approximate time
PartName: 8" ICW Strainers (2) Operation: Remove / Clean Frequency: Weekly	7-2 2002		Gwk	1 hour no loto needed
Device: L.R. Pump ICW Filters				
PartName: Filters Operation: Replace(varies w/ use) Frequency: Weekly				30 min
Device: N2 Spectrograph Detector				
PartName: Detector Operation: Calibrate / Zero Frequency: Daily	04.2002		Gwk	30 min
Device: Van Air Pre-Filter, After-Filter, Oil Scrubber				
PartName: Van Air Operation: Drain Water Frequency: Daily/Weekly				15 min
Device: Air Reservoir, Aftercooler				
PartName: Operation: Drain Water Frequency: Daily/Weekly				15 min
Device: 8" ICW Strainers (2)				
PartName: 8" ICW Strainers (2) Operation: Remove / Clean Frequency: Weekly				
Device: L.R. Pump ICW Filters				
PartName: Filters Operation: Replace(varies w/ use) Frequency: Weekly				
Device: N2 Spectrograph Detector				
PartName: Detector Operation: Calibrate / Zero Frequency: Daily				
Device: Van Air Pre-Filter, After-Filter, Oil Scrubber				
PartName: Van Air Operation: Drain Water Frequency: Daily/Weekly				
Device: Air Reservoir, Aftercooler				
PartName: Operation: Drain Water Frequency: Daily/Weekly				

Maintenance Log - Frequency =Water/monthy

General Description	Date	Hours On Equipment	Technician	Notes
Device: LCW water pumps (4)				approximate time
PartName: LCW water pumps (4) Operation: grease Frequency: monthly	01-2002 2-12 2002		GWK GWK	30 minuts no loto needed

Device: Glycol System 2-17 2002 GWK approximate time

PartName: glycol pumps (2) Operation: grease Frequency: monthly	01-2002 *		GWK	30 minuts no loto needed

* Coupling has been replaced with new Rubber insert on both Coupling

1) Lovejoy L-150 Chicago

2) Sure-Flex T.B. Woods & Sons Co.
Chambersburg, Pa.
6. J

Both replaced on 4/20/02
GK DM R.W.

150 Foot Return Water Hoses Replaced on Circulation Loop

2-12 GWK
2002

Maintenenace Log - Frequency = **1 Month**

General Description	Date	Hours On Equipment	Technician	Notes
Device: Compressor Skid				approximate time
PartName: Balston Oil Removers Operation: Blow Down Frequency: 1 Month	03.2002		GWK	5 min
PartName: Charcoal Absorber Operation: Blow Down 1/4" Vlve. Frequency: 1 Month	03.2002		GWK	5 min
PartName: Final Filter Operation: Blow Down 1/4" Vlve. Frequency: 1 Month	03.2002		GWK	5 min
PartName: 1/4" Vlve. Before Final Operation: Sample Frequency: 1 Month	03.2002		GWK	5 min
Device: Scram Packs				
PartName: Scram Packs Operation: Inspect Frequency: 1 Month				N/A
Device: Building O2 Sensor Heads				
PartName: Building O2 Heads Operation: Test & Inspect Frequency: 1 Month				1 hour
Device: Compressor Skid				
PartName: Balston Oil Removers Operation: Blow Down Frequency: 1 Month				
PartName: Charcoal Absorber Operation: Blow Down 1/4" Vlve. Frequency: 1 Month				
PartName: Final Filter Operation: Blow Down 1/4" Vlve. Frequency: 1 Month				
PartName: 1/4" Vlve. Before Final Operation: Sample Frequency: 1 Month				
Device: Scram Packs				
PartName: Scram Packs Operation: Inspect Frequency: 1 Month				
Device: Building O2 Sensor Heads				
PartName: Building O2 Heads Operation: Test & Inspect Frequency: 1 Month				

Maintenance Log - Frequency = **3 Months**

General Description		Date	Hours On Equipment	Technician	Notes
Device:	**Blue Purifier**				approximate time
PartName:	Absorber Pots	04·2002		GWK	
Operation:	Warm & De-Rime				
Frequency:	3 Months				1.5 hr set up time 48 hr De-Rime
Device:	**Green Purifier**				
PartName:	Absorber Pots				
Operation:	Warm & De-Rime				
Frequency:	3 Months				1.5 hr set up time 48 hr De-Rime
Device:	**Sullair Air Compressor 1**				
PartName:	Oil, Filter, Radiator	04·2002	52,467	GWK	NEW OIL SIGHT GLASS
Operation:	Change, Wash				INSTALLED.
Frequency:	3 Months				4.5 hour loto needed
Device:	**Sullair Air Compressor 2**				
PartName:	Oil, Filter, Radiator	04·2002	48,410	GWK	
Operation:	Change, Wash				
Frequency:	3 Months				4.5 hour loto needed
Device:	**Personal O2 Monitors**				
PartName:	Cells, Batteries				
Operation:	Re-calibrate, Replace				
Frequency:	3 Months				6.0 hour
Device:	**Compressor skid**				
PartName:	Oil Filter 1st STAGE	06·04·02		DM GK RW	
Operation:	Change				
Frequency:	3 Months 2ND STAGE	06·04·02			3.0 hr no loto needed
Device:	**Blue Purifier**				
PartName:	Absorber Pots				
Operation:	Warm & De-Rime				
Frequency:	3 Months				
Device:	**Green Purifier**				
PartName:	Absorber Pots				
Operation:	Warm & De-Rime				
Frequency:	3 Months				
Device:	**Sullair Air Compressor 1**				
PartName:	Oil, Filter, Radiator	07·12		GWK	NOTE X-CHANGE CLEANED
Operation:	Change, Wash	2002			STOP BUTTON REPLACED
Frequency:	3 Months				
Device:	**Sullair Air Compressor 2**				
PartName:	Oil, Filter, Radiator	07·12		GWK	NOTE X-CHANGER CLEANED
Operation:	Change, Wash	2002			STOP BUTTON REPLACED
Frequency:	3 Months				
Device:	**Personal O2 Monitors**				
PartName:	Cells, Batteries				
Operation:	Re-calibrate, Replace				
Frequency:	3 Months				
Device:	**Compressor skid**				
PartName:	Oil Filter				
Operation:	Change				
Frequency:	3 Months				

Maintenance Log - Frequency = **6 Months**

General Description	Date	Hours On Equipment	Technician	Notes
Device: Edwards Chiller				approximate time
PartName: Filters Operation: Check / Replace Frequency: 6 Months				1 hour
Device: Safety Eye Wash				
PartName: Water Operation: Drain, Clean, Refill Frequency: 6 Months				1 hour
Device: Cold Box				
PartName: D. Pump Rougher Operation: Oil Change/Belts Frequency: 6 Months	04.2002		Dm /GWC	1 hour
Device: Distribution Box				
PartName: Turbo Rougher Operation: Oil Change/Belts Frequency: 6 Months				1 hour
Device: Edwards Chiller				
PartName: Filters Operation: Check / Replace Frequency: 6 Months				
Device: Safety Eye Wash				
PartName: Water Operation: Drain, Clean, Refill Frequency: 6 Months				
Device: Cold Box				
PartName: D. Pump Rougher Operation: Oil Change/Belts Frequency: 6 Months				
Device: Distribution Box				
PartName: Turbo Rougher Operation: Oil Change/Belts Frequency: 6 Months				

Maintenance Log - Frequency = **1 Year / 6 Year**

General Description	Date	Hours On Equipment	Technician	Notes
Device: House Air Dryers				approximate time
PartName: Activated Alumna Operation: Change Frequency: 1 Year				4 to 6 hour loto needed
Device: Cold Box				
PartName: Diffusion Pump Operation: Change Oil Frequency: 1 Year				1 hour
Device: Compressor Skid				
PartName: Compressor Oil Operation: Sample For Analysis Frequency: 1 Year				
Device: House Air Dryers				
PartName: Activated Alumna Operation: Change Frequency: 1 Year				
Device: Cold Box				
PartName: Diffusion Pump Operation: Change Oil Frequency: 1 Year				
Device: Compressor Skid				
PartName: Compressor Oil Operation: Sample For Analysis Frequency: 1 Year				
Device: House Air Dryers				
PartName: Activated Alumna Operation: Change Frequency: 1 Year				
Device: Cold Box				
PartName: Diffusion Pump Operation: Change Oil Frequency: 1 Year				
Device: Compressor Skid				
PartName: Compressor Oil Operation: Sample For Analysis Frequency: 1 Year				
Device: Relief Valves				
PartName: Relief Valves Operation: Test Set Pressure Frequency: 6 Years				

Subject: MTF Test Stand 4 documentation
Date: Wed, 31 Jan 2001 09:56:08 -0600
From: Roger Rabehl <rabehl@fnal.gov>
To: soyars@fnal.gov, makara@fnal.gov, cease@fnal.gov,
Ruthe Richard <ruthe@fnal.gov>
CC: Peterson Tom <tommy@fnal.gov>, Rabehl Roger <rabehl@fnal.gov>

MTF Cryo Safety Panel Members -

The first cooldown of the test stand is expected in early March. I want to give each of you ample time to review the information and raise any concerns, as well as allow us time to respond. We will have a walk-through and meeting closer to the start-up date.

Within the next day, I plan to send each of you a copy of the MTF Test Stand 4 documentation. This package will include:

1. Brief introduction to the test stand
2. P&ID
3. Valve and instrument list
4. Failure mode and effect analysis (FMEA)
5. What-if analysis
6. He vessel engineering note
7. Vacuum vessel engineering note
8. ODH analysis
9. Operating procedures
10. PLC logic
11. Operator interface screens

Please contact myself or Tom Peterson with any questions or concerns.

Roger Rabehl
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Technical Division/Development & Test Dept.
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Batavia, IL 60510

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****

Subject: Re: MTF Test Stand 4 documentation
Date: Thu, 15 Feb 2001 13:59:41 -0600
From: Bill Soyars <soyars@fnal.gov>
To: Roger Rabehl <rabehl@fnal.gov>
CC: makara@fnal.gov, cease@fnal.gov, Ruthe Richard <ruthe@fnal.gov>,
Peterson Tom <tommy@fnal.gov>

Concerning the new MTF Stand 4, I just have a few questions after reviewing
the information Roger recently sent out. Email answers are fine, or answers
could wait until we meet.

1. As drawn on the flow schematic (1670-ME-304919), it appears that the
small N2 instrumentation purge lines HV-520-4 and HV-594-4 create trapped
volumes. I suspect that this really isnt a liquid line, that is, the flow
paths in GREEN (code for LN2) in this vicinity should be RED (code for
GN2).

2. Looks like HV-595 is missing from FMEA. No hazards apparently, just for
completeness.

3. I'd like to learn more details on HV-597, specifically about the porting
style that prevents complete isolation of the rupture disks. (For example I
wonder, would resulting pressure drops be very high and quite limiting to
flow, such that even though valve not completely isolated, for practical
purposes it is completely isolated and generating too much backpressure?)

4. This issue isnt directly discussed in the write up. I just wanted to
followup about a design issue concerning the lamda plate tie down rods. Was
testing done to show quench pressures can be handled? Any issues relating to
this?

Thats what I have for now....

Bill Soyars

Roger Rabehl wrote:

> MTF Cryo Safety Panel Members -
>
> The first cooldown of the test stand is expected in early March. I want
> to give each of you ample time to review the information and raise any
> concerns, as well as allow us time to respond. We will have a
> walk-through and meeting closer to the start-up date.
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> Within the next day, I plan to send each of you a copy of the MTF Test
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>
> Please contact myself or Tom Peterson with any questions or concerns.
>
> Roger Rabehl
> Mechanical Engineer
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> P.O. Box 500
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>
> Ph: (630) 840-8855
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>
> **********

Subject: [Fwd: Review of test stand 4]
Date: Fri, 16 Feb 2001 07:50:24 -0600
From: Bill Soyars <soyars@fnal.gov>
To: Tom Peterson <tommy@fnal.gov>, "Ruthe, Richard" <ruthe@fnal.gov>,
Jerry Makara <makara@fnal.gov>, Herman Cease <cease@fnal.gov>,
Rabehl Roger <rabehl@fnal.gov>

Allow me to forward comments made by Herman, concerning the documentation
for the
new stand 4.

Bill

Herman Cease wrote:

> Bill,
>
> I had a couple of comments about the test stand 4 review.
>
> The GHE color code should not be black, nearly everything on the page is
black.
>
> I didnt notice HV-507 thru 510 on the valve list
>
> Drawing numbers should be on the drawing whenever the flow leaves the
page,
> ie. helium return to purifier should have a drawing number for the
purifier,
> also when flow enters the drawing from the distribution box, there should
be a
> drawing number for the distribution box.
>
> A trapped volume relief valve may be needed between HV513 and HV 570 on
the He
> line (purple). Also above HV 569
>
> Herman

Subject: Re: [Fwd: Review of test stand 4]
Date: Fri, 16 Feb 2001 09:24:22 -0600
From: Roger Rabehl <rabehl@fnal.gov>
To: Bill Soyars <soyars@fnal.gov>
CC: Tom Peterson <tommy@fnal.gov>, "Ruthe, Richard" <ruthe@fnal.gov>,
Jerry Makara <makara@fnal.gov>, Herman Cease <cease@fnal.gov>,
rabehl@fnal.gov

Panel Members -

Let me reply to Herman's comments now. I will work on responses to Bill's
comments
later today.

> > The GHE color code should not be black, nearly everything on the page is
black.
>

The color coding is easy enough to change. A new color will be assigned to
GHe.

>
> > I didnt notice HV-507 thru 510 on the valve list

You're right. Valves HV507-4 through HV510-4 were accidentally left off the
V&I
list. They will be added. These four valves are Nupro SS-4BK-VCO valves
(bellows
valves with 1/4 male VCO ends) from the stockroom.

>
> > Drawing numbers should be on the drawing whenever the flow leaves the
page,
> > ie. helium return to purifier should have a drawing number for the
purifier,
> > also when flow enters the drawing from the distribution box, there
should be a
> > drawing number for the distribution box.

Drawing numbers will be added to reference other P&IDs of the MTF cryo
system.

> > A trapped volume relief valve may be needed between HV513 and HV 570 on the He
> > line (purple). Also above HV 569

Trapped volume reliefs are not required at these locations. HV569-4 is a bayonet ball valve on the LHe return line to the distribution box subcooler. HV570-4 is a bayonet ball valve on the LHe supply line. Because a bayonet goes through each of these valves, they cannot be closed when the transfer lines are in place. The trapped volume reliefs PSV561-4 (supply line) and PSV562-4 (return line) located at these bayonet ball valves are therefore sufficient.

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****

Subject: Re: MTF Test Stand 4 documentation
Date: Mon, 19 Feb 2001 11:09:02 -0600
From: Roger Rabehl <rabehl@fnal.gov>
To: Bill Soyars <soyars@fnal.gov>
CC: makara@fnal.gov, cease@fnal.gov, Ruthe Richard <ruthe@fnal.gov>,
Peterson Tom <tommy@fnal.gov>, rabehl@fnal.gov

Panel Members -

In response to Bill's questions from last week...

Bill Soyars wrote:

> Concerning the new MTF Stand 4, I just have a few questions after reviewing
> the information Roger recently sent out. Email answers are fine, or answers
> could wait until we meet.
>
> 1. As drawn on the flow schematic (1670-ME-304919), it appears that the
> small N2 instrumentation purge lines HV-520-4 and HV-594-4 create trapped
> volumes. I suspect that this really isnt a liquid line, that is, the flow
> paths in GREEN (code for LN2) in this vicinity should be RED (code for
GN2).

That is true. The line contains GN2, but it was color-coded for LN2 because
it
is measuring the pressure and temperature of LN2. The same thing is true of
the
He instrumentation. The P&ID will be changed to show GN2/GHe downstream of
the
isolation valves.

>
> 2. Looks like HV-595 is missing from FMEA. No hazards apparently, just for
> completeness.

HV595-4 has been added to the FMEA. I also found that it was not in the
valve &

instrument list, so it was added there as well.

>
> 3. I'd like to learn more details on HV-597, specifically about the porting
> style that prevents complete isolation of the rupture disks. (For example
I
> wonder, would resulting pressure drops be very high and quite limiting to
> flow, such that even though valve not completely isolated, for practical
> purposes it is completely isolated and generating too much backpressure?)

HV597-4 is a Worcester diverter ball valve. The ball has a bottom inlet
port,
and two outlet ports 90 degrees apart. When the valve is in one position,
one
of the outlet ports is fully open. When the valve handle is moved 90 degrees,
the second outlet port is fully open. The most restrictive position is when
the
handle is moved only 45 degrees, in which case both ports are partially open
and
provide 70% of the maximum flow area (according to the product bulletin).

If the flow area is reduced to 70%, this is the same as reducing the rupture
disk diameter from 1.5 inches to 1.25 inches. A 1.25 inch rupture disk
would
allow the test stand pressure to rise to approximately 170 psia. The 1.5
inch
rupture disk allows the test stand pressure to rise to 142 psia (127 psig)
as
specified in the relief sizing document.

To answer your question, the rupture disks cannot be completely isolated but
it

is possible to generate an additional 30 psi of backpressure. The handle of
the
diverter valve could be locked in place or even removed to prevent this
situation..

>
> 4. This issue isnt directly discussed in the write up. I just wanted to
> followup about a design issue concerning the lamda plate tie down rods.
Was
> testing done to show quench pressures can be handled? Any issues relating
to
> this?
>

Yes, testing was done in early 1999. Prototype tie-down rods were fabricated at
half-scale and tested on a tensile machine at the Materials Lab in the Village.
The goal of the tests was to determine whether the threads and fillets on
the
tie-down rods result in high stress concentrations at a high loading rate.
The
maximum loading rate was equivalent to a 30 atm/s rate of pressure differential
increase across the lambda plate, but the high loading rate had no effect on
the
part strength when compared to rods tested at much lower loading rates.

A model of lambda plate check valve operation shows that during the quench
venting, the pressure differential across the lambda plate is expected to be
no
greater than 3 atm. Even at a 3 atm pressure differential, the tie-down
rods
have a safety factor of 4.5 based on yield strength.

Roger Rabehl

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         (630) 840-6724
Pager: (630) 722-0292

****

Subject: Stand 4 walkthrough results
Date: Wed, 07 Mar 2001 11:46:24 -0600
From: Bill Soyars <soyars@fnal.gov>
To: Tom Peterson <tommy@fnal.gov>, "Ruthe, Richard" <ruthe@fnal.gov>,
Jerry Makara <makara@fnal.gov>, Herman Cease <cease@fnal.gov>,
Rabehl Roger <rabehl@fnal.gov>

The MTF Cryogenic Safety Review Panel performed an inspection of the Stand 4 Feed Can installation last week. Our comments are:

1. We ask that the upcoming MTF Electrical Safety Review Panel inspection consider the issue of potential personnel exposure to the feed can power leads. The Cryogenic Safety Panel wishes to receive information on what this panel recommends, after they have arrived at their decisions.

2. At the rupture disk selector 3 way valve (HV-597-4), we recommend a cautionary label to warn against leaving this valve in an "in-between" position.

3. We recommend that IND numbers for pressure vessel identification be
added to the flow schematic.

4. We noticed a pipe clamp blank off on a stub extending from the quench

header. Is this clamp rated for quench pressures?

5. Water dripping from heat exchanger during warmup could pose a slip hazard.

6. The plexiglass shield protecting personnel from the energized crane bus would benefit from a caution sign explaining the hazard.

7. Procedures should address the potential interference between the crane and U-tubes during stinging operations. This should include procedures for abnormal uses of the crane platform as well, such as maintenance activities at the
ceiling (e.g. work on lights, ballasts, sprinklers) which can be performed from
its platform. The potential interference with U-tubes should should especially be considered during these activities, since the crane could
be under the control
of FESS personnel or even outside subcontractors.

8. Access to the emergency power stop button near the heat exchangers

should be improved. We recognize that within the control room there is an additional stop button that is easily accessible for personnel within
the control room.

Bill Soyars

Subject: Re: Stand 4 walkthrough results
Date: Mon, 12 Mar 2001 10:19:43 -0600
From: Roger Rabehl <rabehl@fnal.gov>
To: Bill Soyars <soyars@fnal.gov>, "Ruthe, Richard" <ruthe@fnal.gov>,
Jerry Makara <makara@fnal.gov>, Herman Cease <cease@fnal.gov>
CC: Tom Peterson <tommy@fnal.gov>, rabehl@fnal.gov

In repsonse to the MTF Cryo Safety Review Panel's comments regarding the
Stand 4 walkthrough:

> 1. We ask that the upcoming MTF Electrical Safety Review Panel
> inspection consider the issue of potential personnel exposure to the
> feed can power leads. The Cryogenic Safety Panel wishes to receive
> information on what this panel recommends, after they have arrived at
> their decisions.

I have forwarded this to Jim Garvey with a request to keep us informed of
any decisions.

>
> 2. At the rupture disk selector 3 way valve (HV-597-4), we recommend a
> cautionary label to warn against leaving this valve in an "in-between"
> position.
>

A sign has been placed at this valve. The sign relates valve handle
position to which rupture disk is online, and it warns against putting the
valve in an in-between position.

>
> 3. We recommend that IND numbers for pressure vessel identification be
> added to the flow schematic.
>

IND numbers have been added to the P&ID. The only IND numbers on the print
are the feed can helium vessel (IND 081) and the feed can vacuum vessel (IND
082).

>

> 4. We noticed a pipe clamp blank off on a stub extending from the quench
>
> header. Is this clamp rated for quench pressures?
>

This clamp has been in place for many years, including during SSC testing,
so it has proven to hold quench pressure. It could be a left-over from a
Tevatron Stand 4. This clamp will be removed and a pipe cap welded in its
place during the next refrigerator shutdown.

>
> 5. Water dripping from heat exchanger during warmup could pose a slip
> hazard.
>

A drip pan has been ordered from McMaster-Carr to be placed under the heat
exchangers to catch water during warmup.

>
> 6. The plexiglass shield protecting personnel from the energized crane
> bus would benefit from a caution sign explaining the hazard.
>

Stickers reading "Danger - High Voltage" have been placed on the plexiglass
shield.

>
> 7. Procedures should address the potential interference between the
> crane and U-tubes during stinging operations. This should include
> procedures for abnormal uses of the crane platform as well, such as
> maintenance activities at the
> ceiling (e.g. work on lights, ballasts, sprinklers) which can be
> performed from
> its platform. The potential interference with U-tubes should should
> especially be considered during these activities, since the crane could
> be under the control
> of FESS personnel or even outside subcontractors.
>

On both ends of each of the U-tubes, stickers have been placed on the vacuum
jacketed line just above the bayonet ball valves saying that the 25 ton
overhead crane must be locked out before the U-tube is pulled.

>
> 8. Access to the emergency power stop button near the heat exchangers
> should be improved. We recognize that within the control room there is
> an additional stop button that is easily accessible for personnel within
> the control room.
>

The flowmeter panel at the heat exchangers was positioned to minimize interference with the emergency power stop button. Although the panel is
stood off approximately 12 inches in front of the box, the panel is low
enough that the stop button box is not obscured. A corner of the panel was
also beveled to minimize the hazard of someone scraping their arm if they
do reach for the button. The issue of access has been considered, but we
are not planning any additional modifications at this time.

In addition to the stop button in question and the stop button in the control room, there is a third stop button. It is located at the other end
of the distribution box.

Roger Rabehl
Mechanical Engineer
Technical Division/Development & Test Dept.
Fermi National Accelerator Laboratory
P.O. Box 500
M.S. 344
Batavia, IL 60510

Ph: (630) 840-8855
Fax: (630) 840-5792
         (630) 840-6724
Pager: (630) 722-0292

****

Subject: Re: [Fwd: [Fwd: Stand 4 walkthrough results]]
Date: Tue, 20 Mar 2001 08:50:57 -0600
From: Bill Soyars <soyars@fnal.gov>
To: Roger Rabehl <rabehl@fnal.gov>
CC: makara@fnal.gov, cease@fnal.gov, ruthe@fnal.gov

Roger,
With your earlier email response on 3/12, and with us staying informed on
the
electrical safety review, I believe you have addressed the Cryo Safety Panel's
issues. I will work on a cooldown permission memo this morning. If any commitee
members have any further thought, feel free to contact me this AM.
Bill

Roger Rabehl wrote:

> Panel members -
>
> A forwarded message I received from Jim Garvey is attached. It is
> regarding the electrical safety of Stand 4.
>
> The test stand is currently being leak-checked. Are there any
> additional issues that the panel would like us to address? What is
the
> current timeline for receiving a cooldown permission from the panel?
>
> Roger
>
>

--
>
> Subject: Re: [Fwd: Stand 4 walkthrough results]
> Date: Mon, 12 Mar 2001 10:00:04 -0600
> From: Jim Garvey <garvey@fnal.gov>
> Organization: Fermilab
> To: Roger Rabehl <rabehl@fnal.gov>
> References: <3AACEF08.F38E665F@fnal.gov>
>
> Roger,
> A request for the electrical review has been made to AD via Dan
Wolff. He
has
> been tied up with the start up for run II and I expect sometime this
week

to
> speak to him about it.
> Particularly, there will be no exposed bus at the top. It must be
covered
with
> a "barrier", in this case that can be rubber as it is in VMTF. They
may
> recommend that the area be fenced in some way, but I rather doubt
it. We
are
> attempting to keep any restrictions as short as possible.
>
> Roger Rabehl wrote:
>
> > Hi Jim -
> >
> > >From the attached Stand 4 cryo walkthrough comments, the first
item
> > relates to electrical safety. What are the current ideas about
limiting
> > personnel exposure to the power leads? Please keep us informed
> > regarding any decisions. Thanks.
> >
> > Roger
> >

--
> >
> > Subject: Stand 4 walkthrough results
> > Date: Wed, 07 Mar 2001 11:46:24 -0600
> > From: Bill Soyars <soyars@fnal.gov>
> > To: Tom Peterson <tommy@fnal.gov>, "Ruthe, Richard"
<ruthe@fnal.gov>,
> >   Jerry Makara <makara@fnal.gov>, Herman Cease
<cease@fnal.gov>,
> >   Rabehl Roger <rabehl@fnal.gov>
> >
> > The MTF Cryogenic Safety Review Panel performed an inspection of
the
> > Stand 4 Feed Can installation last week. Our comments are:
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> > their decisions.

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> > 8. Access to the emergency power stop button near the heat exchangers
> > should be improved. We recognize that within the control room there is
> > an additional stop button that is easily accessible for personnel within
> > the control room.
> >
> > Bill Soyars

>
> --
> Jim Garvey
> Head of Electrical Systems
> TD/DT, Mail Stop 344
> Fermilab phone: 630-840-4160
> P.O. Box 500 fax: 630-840-5792
> Batavia, IL 60510 pager: 630-612-0351

Subject: MTF w/ std 4 cooldown
Date: Tue, 20 Mar 2001 11:24:42 -0600
From: Bill Soyars <soyars@fnal.gov>
To: pjlimon@fnal.gov, Tom Peterson <tommy@fnal.gov>,
Rabehl Roger <rabehl@fnal.gov>
CC: Jerry Makara <makara@fnal.gov>, "Ruthe, Richard" <ruthe@fnal.gov>,
Herman Cease <cease@fnal.gov>, "William M. Soyars"
<soyars@fnal.gov>

March 20, 2001
To: P. Limon, Technical Division Head
From: W. Soyars, Chair, MTF Cryogenic Safety Review Panel
Subject: MTF Cooldown and Operation of Stand 4

The MTF Cryogenic Safety Panel has reviewed the request for cooldown and operation of the MTF at cryogenic temperatures. The review encompassed the refrigerator system and the new stand 4 which will support LHC testing. Per Fermilab ES&H Manual (FESHM) Chapter 5032, the
panel recommends cooldown of the system per standard procedures. The standard procedures are to include verification of active relief systems
for the single phase helium, two phase helium, nitrogen, and vacuum spaces.

The panel provided comments and remarks to MTF personnel based on a walk-through inspection and a review of the following documentation: flow schematics, valve and instrument list, failure mode and effect analysis, what-if analysis, He and vacuum vessel engineering notes (previously reviewed), operating procedures, PLC logic, and operator interface screens. The panel's comments have been satisfactorily addressed.

The panel notes that this review has not considered any test magnets or
test plans. Furthermore, the panel notes that the MTF Electrical Safety
Review Panel will specifically review the protection of personnel from
potential exposure to the feed can power leads.

Panel cc: J. Makara
R. Ruthe
H. Cease

Subject: Re: MTF w/ std 4 cooldown
Date: Tue, 20 Mar 2001 15:36:07 -0600
From: Peter Limon <pjlimon@fnal.gov>
To: Bill Soyars <soyars@fnal.gov>
CC: Tom Peterson <tommy@fnal.gov>, Rabehl Roger <rabehl@fnal.gov>,
Jerry Makara <makara@fnal.gov>, "Ruthe, Richard"
<ruthe@fnal.gov>,
Herman Cease <cease@fnal.gov>

Bill:

Thank you very much.

With this note, I approve commencing cooldown and cryogenic operation of the
MTF Stand 4 using standard procedures as referred to in your memo attached
below.

I note that the test magnet has been previously reviewed and approved by me
with a Director's exemption. I also note that the magnet cannot be powered
until the MTF Electrical Safety Committee reports to me and I approve operation.

Peter Limon
Head, Technical Division

Bill Soyars wrote:

> March 20, 2001
> To: P. Limon, Technical Division Head
> From: W. Soyars, Chair, MTF Cryogenic Safety Review Panel
> Subject: MTF Cooldown and Operation of Stand 4
>
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> and operation of the MTF at cryogenic temperatures. The review
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Safety
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from
> potential exposure to the feed can power leads.
>
> Panel cc: J. Makara
> R. Ruthe
> H. Cease